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Loneliness Before and During the COVID-19 Pandemic: A Systematic Review With Meta-Analysis

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The COVID-19 pandemic and measures aimed at its mitigation, such as physical distancing, have been discussed as risk factors for loneliness, which increases the risk of premature mortality and mental and physical health conditions. To ascertain whether loneliness has increased since the start of the pandemic, this study aimed to narratively and statistically synthesize relevant high-quality primary studies. This systematic review with meta-analysis was registered at PROSPERO (ID CRD42021246771). Searched databases were PubMed, PsycINFO, Cochrane Library/Central Register of Controlled Trials/EMBASE/CINAHL, Web of Science, the World Health Organization (WHO) COVID-19 database, supplemented by Google Scholar and citation searching (cutoff date of the systematic search December 5, 2021).

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The data are available at https://osf.io/fp732/?view_only=fb52159e65a245b89be6021286f65e7d

The experimental materials are available at https://osf.io/fp732/?view_only=fb52159e65a245b89be6021286f65e7d

The preregistered design is available at https://www.crd.york.ac.uk/prospero/display_record.php?RecordID=246771

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Summary data from prospective research including loneliness assessments before and during the pandemic were extracted. Of 6,850 retrieved records, 34 studies (23 longitudinal, 9 pseudolongitudinal, 2 reporting both designs) on 215,026 participants were included. Risk of bias (RoB) was estimated using the risk of bias in non-randomised studies—of interventions (ROBINS-I) tool. Standardized mean differences (SMD, Hedges' g) for continuous loneliness values and logOR for loneliness prevalence rates were calculated as pooled effect size estimators in random-effects meta-analyses. Pooling studies with longitudinal designs only (overall $N = 45{,}734$), loneliness scores (19 studies, SMD = 0.27 [95% confidence interval = 0.14–0.40], $Z = 4.02$, $p < .001$, $I^2 = 98\%$) and prevalence rates (8 studies, logOR = 0.33 [0.04–0.62], $Z = 2.25$, $p = .02$, $I^2 = 96\%$) increased relative to prepandemic times with small effect sizes. Results were robust with respect to studies' overall RoB, pseudolongitudinal designs, timing of prepandemic assessments, and clinical populations. The heterogeneity of effects indicates a need to further investigate risk and protective factors as the pandemic progresses to inform targeted interventions.

Public Significance Statement

This synthesis of international research with a focus on longitudinal study designs shows small, but robust increases in loneliness during the COVID-19 pandemic across gender and age groups. As loneliness jeopardizes mental and physical health, these findings indicate that public health responses to the continuing pandemic should include monitoring of feelings of social connectedness and further research into risk and protective factors.

Keywords: COVID-19, loneliness, mental health, pandemic, social isolation

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Even before the COVID-19 pandemic, social isolation and loneliness were becoming major public health and policy concerns, largely due to their serious impact on longevity, mental and physical health, and well-being (Fried et al., 2020; Holt-Lunstad et al., 2015; Leigh-Hunt et al., 2017). The pandemic and the attendant measures to contain it have made the issues of social isolation and loneliness even more salient (Gruber et al., 2021; Holt-Lunstad, 2021). Since its outbreak, many countries around the world have enacted shelter-in-place and physical distancing orders, travel bans, and switched to remote work and education resulting in fewer social contacts (i.e., greater social isolation), which may in turn have increased loneliness. Social isolation and loneliness, though related, are distinct concepts: "social isolation" is the objective state of having a small network of kin and nonkin relationships and thus few or infrequent interactions with others. Some studies have found only weak correlations between social isolation and loneliness (Steptoe et al., 2013; Tanskanen & Anttila, 2016): Socially isolated people are not necessarily lonely (in fact, *solitude* describes a positive valuation) and vice versa. By contrast, "loneliness" is the painful feeling—or "social pain"—that results from a discrepancy between the quantity (e.g., number of social contacts per day) and/or the quality (referring to the subjective experience of characteristics such as affection, intimacy, or conflict) of their desired and actual social connections (Cacioppo et al., 2014; Perlman & Peplau, 1981).

In the pandemic context, the distinction between social isolation and loneliness is especially important as many people have fewer contacts, but not all of them feel lonely. This is because loneliness is related to factors other than social isolation, including temporally stable characteristics of the individual (Mund et al., 2020) and their environment such as personality traits, need for contact and expectations of relationships (Qualter et al., 2015), physical and mental health, and cultural norms (Gierveld et al., 2018; Lim et al., 2020). These variables can explain why the pandemic does not affect everyone similarly. For instance, an investigation of the German population showed that extraverted individuals reported greater increases in loneliness during the pandemic (Entringer & Gosling, 2021).

However, it remains unclear whether loneliness has increased *overall* since the pandemic started (e.g., Killgore et al., 2020; Sutin et al., 2020). Studies have reported stable (Peng & Roth, 2021; Sibley et al., 2020), as well as increases (Kovacs et al., 2021; Macdonald & Hülür, 2021) and decreases (Bartrés-Faz et al., 2021) in loneliness levels. Beyond a potential impact of the duration of restrictions (Bartrés-Faz et al., 2021), sample- and design-specific effects may account for these heterogeneous findings. A 2021 systematic review and meta-analysis of changes in mental health, focusing on longitudinal studies and natural experiments with prepandemic comparisons, found no evidence of increase in loneliness (based on three studies; Prati & Mancini, 2021). A more recent systematic review, which included neither a meta-analysis nor a metaregression (Buecker & Horstmann, 2021), found that longitudinal studies mainly reported increases in loneliness.

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The present study aims to shed light on the question of whether there were changes in loneliness in the context of the COVID-19 pandemic by updating the evidence and combining a systematic review with a meta-analysis of high-quality studies. The systematic review includes studies with longitudinal (prospective studies repeatedly assessing the same sample) or pseudolongitudinal design (cross-sectional surveys of different samples, using the same measures) which include a prepandemic assessment. The meta-analysis pools longitudinal studies only. Regarding types of assessment, the focus was on loneliness defined as a painful subjective feeling. The primary aim of the study was to ascertain whether overall levels and prevalence rates of loneliness changed since the start of the pandemic. The secondary aim was to explore statistical predictors of the change in a metaregression, including study-level variables such as design, sample mean age, gender distribution, and risk of bias (RoB). The study protocol was registered before conducting the search.

Method

Search Strategy and Inclusion and Exclusion Criteria

Throughout the systematic review, the latest preferred reporting items for systematic reviews and meta-analyses (PRISMA) guidelines were followed (Page et al., 2021). Articles had to fulfill the following inclusion criteria: (a) address the current SARS-CoV-2/COVID-19 pandemic, (b) report participants' responses on loneliness measures, and (c) contain at least one prepandemic assessment (cutoffs for regional onset were 12/2019 for Asia and Oceania, 01/2020 for North America, Europe, and Africa, and 02/2020 for South America) and one assessment during the pandemic. Only longitudinal and pseudolongitudinal designs were included. Studies using retrospective assessments (e.g., participant-reported changes in loneliness since the start of lockdown), studies published before 2019, non-full-text articles, articles not reporting original research, and articles in languages other than German, English, Spanish, French, Italian, or Chinese were excluded. No further restrictions were placed on the setting, target population, and study design.

Information Sources

The following electronic databases were searched: PubMed, PsycINFO, the Cochrane Library/Cochrane Central Register of Controlled Trials, Web of Science, and the COVID-19 database of the World Health Organization (WHO; comprising also PubMed and PsycINFO plus Elsevier, a gray literature database, ICTRP, LILACS, Medline, and the Preprint-Servers BioRxiv and MedRxiv, Scielo, and SSRN). The search terms are included in Supplemental Material I. The COVID-19 part of the search strategy was adapted from that developed by the working group for evidence-based medicine within the German working group for medical librarianship (Arbeitsgemeinschaft für medizinisches Bibliothekswesen e.V.). The search was supplemented by other sources (citation searching, Google Scholar, websites of governments/organizations such as the USA's National Institutes of Health, U.K.'s National Institute for Health Research, and German Institute for Economic Research).

Study Selection

Articles that did not fit the inclusion criteria were excluded after screening the abstract and title. The remaining relevant full-text records were screened for eligibility. This step was conducted independently by four members of the research group (postdoctoral/senior researchers with previous experience conducting reviews and/or meta-analyses, three psychologists [two full professors] and one medical doctor [assistant professor]). Discrepancies were resolved through discussion. Senior researchers (mathematician and medical doctor/psychologist, full professors) verified the eligibility of included studies.

Data Collection

The following information was extracted by the same four members of the research group: (a) authors; (b) year of publication; (c) country/region; (d) study type (longitudinal/pseudolongitudinal); (e) participants' age; (f) gender/sex proportions; (g) type of study population (e.g., general or clinical population, including both individuals with mental health and physical health conditions); (h) measure to assess of loneliness; (i) unadjusted levels of loneliness (*M*, *SD*) and/or proportions of lonely participants (*N*, %) including cutoffs for dichotomized data; (j) factors associated with changes in loneliness; (k) restriction measures and duration of restriction measures at the time the assessment of loneliness was

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conducted during the pandemic; (l) time between pre- and during-pandemic assessment; and (m) sample size (for pre-pandemic and during-pandemic assessment). When information about restrictions at the time of assessment was insufficient, further information was sought online. When information on the main outcome was insufficient, the authors of the studies were contacted for additional information. There were six such cases in all of which additional information was provided.

Method for Assessing Risk to Internal Validity/Risk of Bias

Bias domains included in the risk of bias in non-randomised studies—of interventions (ROBINS-I) tool (*Cochrane Handbook for Systematic Reviews of Interventions version 6.2*, 2021, Chapter 25, Section 4) were used. RoB was rated with regard to confounding, selection of participants, classification of interventions (for this study: clarity regarding time of assessment, extent of restrictions), deviation from intended intervention (for this study: adherence to restrictions), missing data, measurement of outcomes, and selection of reported result/effect estimate. For each study and domain, the RoB was independently rated by two authors as "low," "moderate," or "serious." Their assessments were merged. For use in sensitivity analyses and metaregression, an overall RoB rating was constructed (≥1 "serious" rating in any domain resulted in a "serious" overall RoB; overall "low" RoB was only present when all domains were rated "low" risk; otherwise, overall risk was considered "moderate"). RoB across studies was estimated by funnel plots/graphs, both using the standard error of the observed outcomes as predictors. Tests of potential funnel plot asymmetry were performed using Egger's regression and Begg and Mazumdar's rank correlation for continuous outcomes and using Kendall's Tau rank correlation test for dichotomous outcomes. The R-based program jamovi (The jamovi project (2021), Version 1.0.7.0) was used for funnel plotting and funnel plot skewness estimation analyses.

Summary Measures/Method of Synthesis

For all data pooling, random-effects meta-analyses were modeled. The main analyses included only original studies with longitudinal designs. For interval- or pseudo-interval-scaled outcomes (continuous loneliness scores), weighted standardized mean differences (Hedges' g) were used as effect size estimators. For binary outcomes (prevalence of loneliness), logarithmized odds ratios were calculated and used for data pooling. Effect sizes were interpreted following Cohen (1992), that is, $d = 0.2$ is generally considered a small, $d = 0.5$ a medium, and $d = 0.8$ a large effect. For both pooling analyses, mean effect sizes and their 95% confidence intervals (CIs) were calculated; summary estimates were displayed using Forest plots. To ascertain the results' robustness, a series of sensitivity analyses were performed (a) including only studies with no "serious" or "critical" overall RoB rating, (b) combining longitudinal and pseudolongitudinal study designs, (c) incorporating prepandemic assessments that overlapped with the date cutoffs specified above, and (d) excluding clinical populations. This was done for continuous data using the same methodological approach for data pooling as for the main analyses.

For all effect calculations, values from the prepandemic assessment were contrasted with assessments obtained during the pandemic. To test for overall effects, Z statistics at a 5% alpha-error-probability level were calculated for all quantitative comparisons. Between-effects heterogeneity was assessed using restricted maximum-likelihood I^2 and Tau^2 statistics. To detect outliers at the study level, studentized residuals and Cook's distances were used. Outliers were Bonferroni corrected with two-sided α threshold = 0.05. Analyses were performed using the meta analysis jamovi R (MAJOR) package for jamovi.

Due to considerable between-effects heterogeneity, an exploratory metaregression was modeled. Independent variables included as follows: (a) the duration of restrictions when the assessment was conducted (days), (b) age (mean; decades), (c) time between the two assessments (months), (d) sex/gender (% women), (e) sample type (0 = no clinical sample, 1 = clinical sample), (f) study type (0 = longitudinal, 1 = pseudolongitudinal), (g) assessment of loneliness (0 = validated scale, 1 = author-developed item(s)), (h) studies' overall RoB (0 = moderate, 1 = serious), and (i) extent of restrictions at time of assessment (0 = soft, 1 = hard). The latter categories were defined in line with previous research (e.g., Plümper & Neumayer, 2022; soft restrictions: recommendations, ongoing provision of nonessential services while prohibitions of larger gatherings can apply; hard restrictions: stay-

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at-home orders with few exceptions, provision of essential services only). If restrictions had changed over the course of the study assessment and/or differed between regions, those most characteristic of study period and region (i.e., implemented in most places most of the time) were considered. The dependent variable was the effect size for loneliness (continuous). If both a longitudinal and a pseudolongitudinal design were reported, data from the former were used. For the regression model, a syntax for statistical product and service solutions (IBM SPSS) was used (David B. Wilson; Meta-Analysis Modified Weighted Multiple Regression; MATRIX procedure Version 2005.05.23). Inverse variance-weighted random intercepts and fixed slopes regression models were calculated. Homogeneity analysis (Q and p values), metaregression estimates (95% CIs and p values), and Z statistics were calculated. The regression used a backward selection of predictors (regressors with the highest significance levels were removed from the model in a stepwise way unless their removal implied a decrease of >10% in explained variance; backward selection was terminated once only statistically significant regressors remained in the model or a relevant increase in heterogeneity was observed [i.e., nonsignificant Cochrane's Q]). Underlying data and code are available via the Open Science Framework: https://osf.io/fp732.

Results

Study Selection

The flowchart in Figure 1 displays the search and selection process. The initial search resulted in 6,850 records through database and register searching (WHO COVID-19 database = 3,116, PubMed/MEDLINE = 1,779, PsycINFO = 369, Web of Science = 1,201, Cochrane Library/Central Register of Controlled Trials = 385). Duplicate records were removed following several steps as suggested by Bramer et al. (2016). Steps 1 and 2 were conducted automatically with Endnote X9.3.1; for the next steps, one author manually checked for duplicate records. After removal of duplicates (n = 3,094), and records not matching all inclusion criteria or fulfilling exclusion criteria, respectively, in title and abstract screening (n = 3,672), full texts of 84 remaining records were assessed for eligibility. There were three studies for which the author group at first arrived at different ratings, equaling an agreement of 96.4% before the discussion. Fifty-six studies were excluded due to inadequate measurement (n = 17; e.g., assessment of social withdrawal instead of loneliness), because there was only one loneliness assessment (n = 13), and/or because the earliest available assessment had been conducted after the regional onset of the pandemic (n = 26; for some studies, multiple reasons applied, see Supplemental Material II). Four studies' "prepandemic" assessment overlapped with the cutoffs (their details are included in Supplemental Material IV). The two longitudinal studies reporting continuous values were included in sensitivity analyses. Peer-reviewed articles were supplemented by additional studies identified via other methods aimed at detecting relevant gray literature, leading to the inclusion of four more publications. Following continuous screening during the revision process, we later added two more studies published after the initial search to include the most recent, relevant research. In total, 34 articles met the eligibility criteria. Two studies could not be included in the meta-analyses: Lippke et al. (2021) due to the use of different instruments assessing loneliness before and during the pandemic and Entringer et al. (2020) because the study reported on a sample that was analyzed and expanded in another publication (Entringer & Gosling, 2021) which we included instead.

Study Characteristics of Included Studies

Table 1 provides a summary of the main information extracted from the 34 eligible articles, totaling 215,026 participants. Most investigations were conducted in central/western Europe (n = 23) or the USA and Canada (n = 8). There were more longitudinal (n = 23) than pseudolongitudinal studies (n = 9). Two articles reported both. Many investigated the general population, with n = 13 focusing on middle-aged and/or older adults and n = 6 on younger people (e.g., adolescents, university students). Specific populations sampled included individuals with cancer or other chronic health conditions (n = 2), caregivers (n = 1), male participants of a well-being intervention (n = 1), or individuals with mental disorders (n = 1).

The most commonly used questionnaires assessing loneliness were the 20-item University of California, Los Angeles (UCLA) loneliness scale (Russell et al., 1980) or its short forms (n = 18), especially the three-item version (Hughes et al., 2004), followed by the six-item de Jong Gierveld loneliness scale (n = 6; Gierveld & Tilburg, 2006). Six studies used

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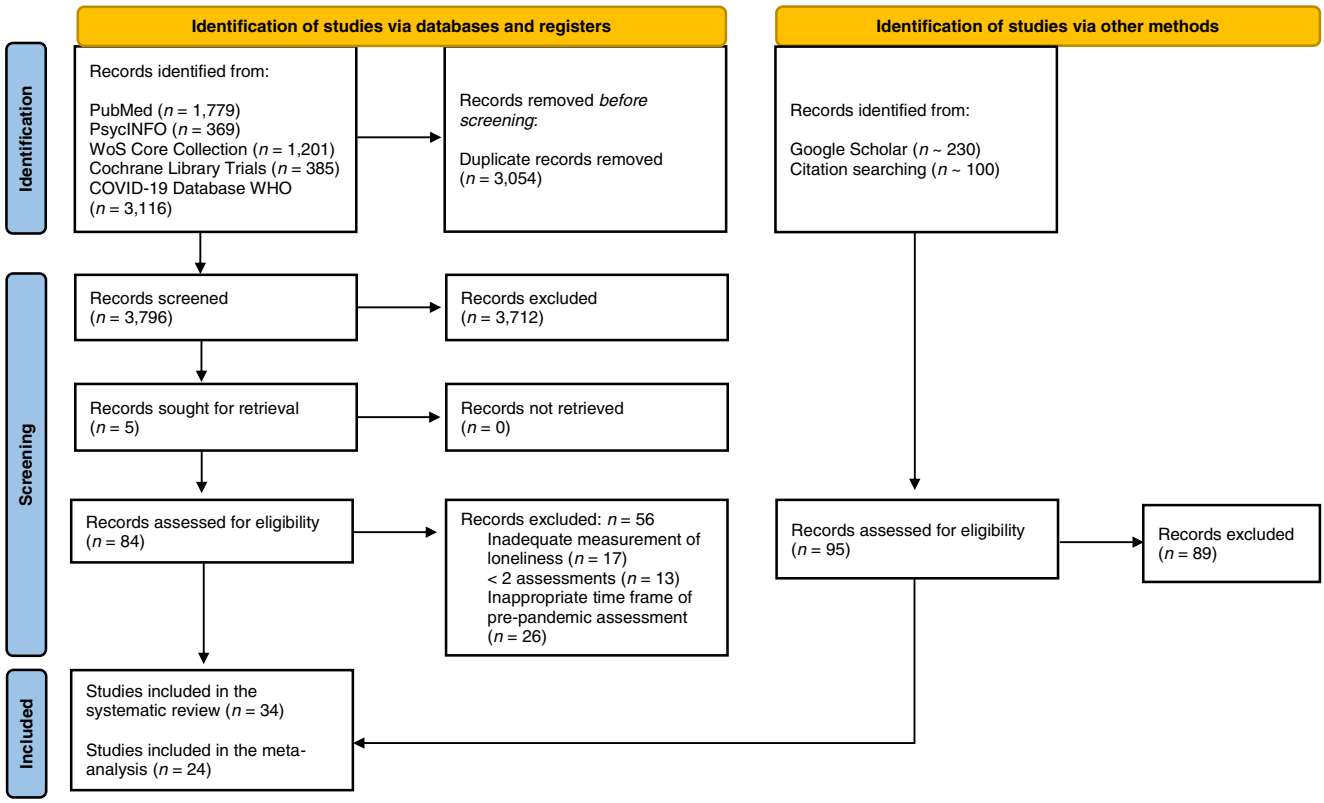
self-created items or adaptations of other measures [(Positive and Negative Affect Schedule (PANAS), Center for Epidemiological Studies Depression (CES-D)]. Of the studies reporting comparisons of loneliness prepandemic and during pandemic, only one reported an overall decrease, 18 reported an overall increase, and eight reported no change. In two cases, changes depended on the coding of the outcome (continuous vs. binary, Herrera et al., 2021) or applied only to one aspect of loneliness (i.e., of the de Jong Gierveld scale, van der Velden et al., 2021).

Increases in loneliness were found both in younger participant groups, such as students (Beutel et al., 2021; Elmer et al., 2020; Entringer & Gosling, 2021; Rogers et al., 2021) and in older participant groups, such as community cohorts of senior citizens (Heidinger & Richter, 2020; Krendl & Perry, 2021; Wong et al., 2020). Within samples, both lower age (Bu et al., 2020; Entringer et al., 2020; Niedzwiedz et al., 2021) and higher age (Bierman & Schieman, 2020) were identified as risk factors. Other variables associated with changes in loneliness included participants' living situation or relationship status, gender, and mental health. Women were more likely to report increases in loneliness than men (Entringer & Gosling, 2021; Entringer et al., 2020; Niedzwiedz et al., 2021;

Figure 1

Study Selection: PRISMA 2020 Flow Diagram for Systematic Reviews Including Searches of Databases, Registers, and Other Sources for the Present Study



Note. PRISMA = Preferred Reporting Items for Systematic Reviews and Meta-Analyses; WHO = World Health Organization. See the online article for the color version of this figure.

Table 1

Studies Reporting About Loneliness Before and During the Pandemic Meeting Inclusion Criteria of the Systematic Review

Authors and country/region	Population	Sample (N)[b]	Study type	Age (M; SD if available)[b]	Women (%)[b]	Loneliness measure	Loneliness continuous prepandemic vs. during pandemic (M, SD)	Loneliness prevalence prepandemic vs. during pandemic (%)	Reported changes in loneliness	Months between before- and during-pandemic assessment	Current extent, duration (days) of restrictions at during-pandemic assessment
Bartrés-Faz et al. (2021) Spain	General public (community cohort)	1,604	Longitudinal	55.7 (7.3)	65	UCLA 3-item loneliness scale	3.74 (1.17) vs. 3.52 (0.9)	n/a	↓	12	Hard, 32 (18–47)
Beutel et al. (2021) Germany	General public (community cohort)	2,516; 2,503	Pseudolongitudinal	48.03 (17.57); 45.99 (17.77)	54.5; 53.1	Previously validated single item	1.35 (0.68) vs. 1.38 (0.78)	n/a	↔	24	Soft, 80 (51–108)
Bierman and Schieman (2020) Canada	Working population	2,477; 2,446	Longitudinal	41.97	48.7; 48.6	Own single item (frequency, past month)	2.09 (1.11) vs. 2.26 (1.16)	59.9 vs. 65.5	↑	6	Soft, 8 (5–11)
Bu et al. (2020) U.K.	General public (community cohort)	31,064; 60,341	Pseudolongitudinal	n/a	51.8; 49.8	UCLA 3-item loneliness scale	4.35 (1.65) vs. 5.03 (1.99)	n/a	↑	28	Hard, 23 (–2 to 48)
Elmer et al. (2020) Switzerland	University students	212	Contains both	n/a	21.7	UCLA 9-item loneliness scale	1.69 (0.49) vs. 1.81 (0.48)	n/a	↑	7	Hard, 31 (16–45)
Entringer et al. (2020)[a] Germany	General public (community cohort)	36,470; 3,599	Longitudinal	n/a	n/a	UCLA 3-item loneliness scale	3 (2.28) vs. 5.2 (2.57)	n/a	↑	36	Hard, 32 (19–45)
Entringer and Gosling (2021) Germany	General public (community cohort)	6,010	Longitudinal	52.64 (13.54)	60.93	UCLA 3-item loneliness scale	1.96 (0.73) vs. 2.69 (0.86)	n/a	↑	36	Soft, 66 (18–113)
Gallagher et al. (2021) U.K.	Cancer patients/ survivors (community cohort)	517	Longitudinal	60	54.2	Own single item (frequency of loneliness, past 4 weeks)	n/a	6 vs. 6	n/a	18	Hard, 25 (10–39)
Gallagher and Wetherell (2020) U.K.	General public (community cohort, oversampled caregivers)	7,527	Longitudinal	50	55	Own single item (frequency, past 4 weeks)	n/a	7.75 vs. 7.6	n/a	18	Hard, 25 (10–39)
Heidinger and Richter (2020) Austria	Older adults (community cohort)	418; 435	Pseudolongitudinal	73 (8.17)	59	6-item De Jong Gierveld loneliness scale	1.61 (0.55) vs. 1.73 (0.6)	n/a	↑	11.5	Hard, 48 (18–78)
Herrera et al. (2021) Chile	General public, oversampled >80 years	721	Longitudinal	72.65; 71.59	69.8	UCLA 3-item loneliness scale	1.06 (2.77) vs. 1.11 (1.61)	43 vs. 47.8	↑ (binary outcome); ↔ (continuous outcome)	8	Hard, 136 (75–196)
Huxhold and Tesch-Römer (2021) Germany	General public (community cohort >40 years)	5,434; 4,609	Longitudinal	63	50	6-item De Jong Gierveld loneliness scale	n/a	9 vs. 13.7	↑	36	Soft, 110 (80–140)
Kivi et al. (2021) Sweden	Older adults (community cohort)	1,034; 1,071	Longitudinal	67.13 (2.00)	47.5; 47.3	4 items derived from the UCLA loneliness scale	1.44 (0.6) vs. 1.44 (0.59)	n/a	↔	9	Soft, 14 (10–18)

(*table continues*)

Table 1 (*continued*)

Authors and country/region	Population	Sample (*N*)[b]	Study type	Age (*M*; *SD* if available)[b]	Women (%)[b]	Loneliness measure	Loneliness continuous prepandemic vs. during pandemic (*M*, *SD*)	Loneliness prevalence prepandemic vs. during pandemic (%)	Reported changes in loneliness	Months between before- and during-pandemic assessment	Current extent, duration (days) of restrictions at during-pandemic assessment
Kovacs et al. (2021) USA	General public (university research participant pool)	189	Longitudinal	27.6	38	20-item UCLA loneliness scale	2.69 (0.49) vs. 2.82 (0.38)	n/a	↑	12	Soft, 78 (63–92)
Krendl and Perry (2021) USA	Older adults (previously participants in lab experiment)	93	Longitudinal	75.2 (6.86)	54.3	UCLA 3-item loneliness scale	5.14 (2.49) vs. 6.05 (2.83)	n/a	↑	9	Soft, 43 (28–58)
Lau et al. (2021) England	University students	97; 99	Longitudinal	21	50; 35.4	20-item UCLA loneliness scale	42.11 (10.06) vs. 42.98 (9.87)	n/a	↔	3	Hard, 46 (1–90)
Lippke et al. (2021)[a] Germany	University students	363; 175	Pseudolongitudinal	19.33 (2.27); 24.22 (3.61)	48.4; 47.4	Prepandemic: ULS-8; during pandemic: adapted single item from CES-D	2.24 (0.67) vs. 1.95 (1.22)	n/a	n/a	22	Soft, 95 (80–109)
Macdonald and Hülür (2021) Switzerland	Older adults (community cohort)	99	Longitudinal	71.49 (4.90)	37.4	Own construction from adaptation of PANAS items	19.78 (12.32) vs. 29.24 (18.19)	n/a	↑	7.5	Hard, 25 (11–39)
McGrath et al. (2021) Ireland	Older men (participating in intervention study)	68; 145	Pseudolongitudinal	69.1 (9.68); 69 (8.53)	0	UCLA 3-item loneliness scale	3.09 (0.51) vs. 4.62 (1.85)	n/a	↑	6	Soft, 96 (81–110)
Mueller et al. (2021) USA	Adolescents	303; 280/930; 314	Contains both	12.4 (1.07); 13 (1.04)	65	UCLA 3-item loneliness scale	1.49 (0.56)/1.49 (0.52) vs. 1.56 (0.57)	n/a	n/a	7	Soft, 95 (70–130)
Niedzwiedz et al. (2021) U.K.	General public (community cohort)	22,823; 10,977	Pseudolongitudinal	49.5[c]	52.1; 52	Own single item (frequency, past 4 weeks)	n/a	7.45; 7.76	↔	24	Hard, 36 (33–38)
Okely et al. (2020) Scotland	Older adults (community cohort)	137	Longitudinal	70; 82	48.2	Own single item (frequency, past week)	n/a	19 vs. 27	↔	24	Hard, 80 (73–86)
Pan et al. (2021) Netherlands	General public with/without mental illness (case–control cohorts)	1,517	Longitudinal	56.1 (13.2)[2]	64	6-item De Jong Gierveld loneliness scale	2.04 (2.02) vs. 2.26 (1.83)	n/a	↑	70	Hard, 42 (21–62)
Peng and Roth (2021) USA	Older adults (community cohort >50 years)	1,141	Longitudinal	63.12 (7.46); 66.87 (7.46)	53	11-item scale derived from the UCLA loneliness scale	1.5 (0.45) vs. 1.5 (0.44)	n/a	↔	48	Soft, 115 (74–156)
Philpot et al. (2021) USA	General public (patient register)	1,996	Longitudinal	60 (14.5)	50	NIH adult social relationship scales	1.8 (0.8) vs. 2 (0.8)	n/a	↑	15	Soft, 44 (29–59)
Rogers et al. (2021) USA	Adolescents (community cohort)	407	Longitudinal	15.5	49.9	UCLA 3-item loneliness scale	1.3 (0.47) vs. 1.44 (0.53)	n/a	↑	7	Hard, 20 (13–26)
Sibley et al. (2020) USA	General public (community cohort)	1,003 (each)	Pseudolongitudinal	51.7 (13.0)	66.6; 64.9	Sense of belonging instrument	5.1 (1.05) vs. 5.07 (1.1)	n/a	↔	6	Hard, 10 (1–19)

(*table continues*)

Table 1 (*continued*)

Authors and country/region	Population	Sample (*N*)[b]	Study type	Age (*M*; *SD* if available)[b]	Women (%)[b]	Loneliness measure	Loneliness continuous prepandemic vs. during pandemic (*M*, *SD*)	Loneliness prevalence prepandemic vs. during pandemic (%)	Reported changes in loneliness	Months between before- and during-pandemic assessment	Current extent, duration (days) of restrictions at during-pandemic assessment
Steptoe and Di Gessa (2021) England	Older adults (community cohort >50 years)	4,887	Longitudinal	70.11 (9.46)	53.3	UCLA 3-item loneliness scale	n/a	34 vs. 36	n/a	24	Soft, 101 (71–131)
Stolz et al. (2021) Austria	Older adults (community cohorts >60 years)	514; 538	Pseudolongitudinal	Median 67 (IQR 9, 520)[c]	54.3	UCLA 3-item loneliness scale	3.51 (0.99) vs. 4.67 (1.65)	n/a	↑	60	Soft, 70 (62–78)
Stone (2020) USA	General public	3,000 (each)	Pseudolongitudinal	n/a	n/a	UCLA 3-item loneliness scale	0.35 vs.0.35	15.5 vs. 15.3	↔	12	Soft, 101 (95–106)
van der Velden et al. (2021) Netherlands	General public (community cohort)	4,084	Longitudinal	45	50.7	6-item De Jong Gierveld loneliness scale	6.90 (1.42) vs. 7.05 (1.34)	n/a	↑ (for emotional loneliness)	96	Soft, 97 (82–111)
van Tilburg et al. (2020) Netherlands	Older adults (community cohort >65 years)	1,502	Longitudinal	72	49	6-item De Jong Gierveld loneliness scale	Social loneliness: 0.95 (1.15) vs. 1.17 (1.20) Emotional loneliness: 0.48 (0.91) vs. 0.97 (0.97)	n/a	↑	7	Hard, 65 (54–76)
Werner et al. (2021) Germany	University students	443	Longitudinal	22.8 (3.3)	77	UCLA 3-item loneliness scale	3.89 (2.73) vs. 5.89 (2.69)	n/a	↑	11	Soft, 95 (81–109)
Wong et al. (2020) Hong Kong	Older adults with chronic health conditions	583	Longitudinal	70.9 (6.1)	72.6	6-item De Jong Gierveld loneliness scale	1.6 (1.85) vs. 2.9 (2.46)	40.5 vs. 70.1	↑	18	Soft, 67 (37–96)

Note. For ranges (i.e., with respect to assessment periods and durations of restrictions), means are reported. Cutoffs for reported prevalence rates: Gallagher et al. (2021) and Gallagher and Wetherell (2020) "often" lonely; Herrera et al. (2021): >3; McGrath et al. (2021): ≥6; Niedzwiedz et al. (2021): "often" lonely; Steptoe and Di Gessa (2021): ≥5; Wong et al. (2020): no loneliness: 0–1, moderate loneliness: 2–4, severe loneliness: 5–6; Huxhold and Tesch-Römer (2021): Affirmation of the majority of negative statements, denial of the majority of positive statements; Stone (2020): for each item: response option "often." N/A = not applicable; CES-D = Center for Epidemiological Studies Depression; NIH = National Institute of Health; PANAS = Positive and Negative Affect Schedule; UCLA = University of California, Los Angeles; ULS-8 = University of California Los Angeles Loneliness Scale.

[a] These studies could not be included in the meta-analyses and metaregression. [b] Report of two numbers indicates differences in pre-/during-pandemic samples. [c] Age was assessed during pandemic, not prepandemic.

Christopher Mikton

Philpot et al., 2021; Wong et al., 2020). Those who lived alone (Bartrés-Faz et al., 2021; Heidinger & Richter, 2020; Huxhold & Tesch-Römer, 2021; McGrath et al., 2021; Okely et al., 2020; Stolz et al., 2021; Wong et al., 2020) and/or were single during the pandemic (Huxhold & Tesch-Römer, 2021; Stone, 2020) were particularly at risk for higher levels of loneliness compared to prepandemic assessments. Lastly, increased loneliness was associated with mental disorders (Pan et al., 2021) and distress, for example, anxiety and depression symptoms (Bierman & Schieman, 2020; Gallagher et al., 2021; Gallagher & Wetherell, 2020; Herrera et al., 2021; Kivi et al., 2021; Okely et al., 2020; van der Velden et al., 2021).

Results of Individual Studies and Meta-Analysis

The main pooled effect estimates for the primary outcome of loneliness, based on longitudinal studies only, are displayed in Figures 2 (continuous data) and 3 (prevalence rates). Together, these analyses included 45,734 participants from four continents. The during-pandemic assessments yielded higher continuous loneliness scores than the prepandemic assessments, standardized mean differences (SMD) = 0.27 95% CI [0.14–0.40], and prevalence rates, logOR = 0.33 95% CI [0.04–0.62]. Based on the examination of the studentized residuals, robustness analyses revealed that there was no indication of outliers and according to the Cook's distances, none of the studies were overly influential.

Sensitivity Analyses

The sensitivity pooled effect estimates for the primary outcome of loneliness are displayed in Table 2 (for a visual depiction, see Supplemental Material III). The main findings of the longitudinal studies were robust against results from 14 studies with serious RoB, SMD = 0.41 95% CI [0.11–0.71], two studies with clinical populations, SMD = 0.26 95% CI [0.12–0.40], six studies with pseudolongitudinal designs, SMD = 0.30 95% CI [0.17–0.42], and two studies whose prepandemic assessment period overlapped with the prespecified date cutoffs, SMD = 0.27 95% CI [0.14–0.39].

Risk of Bias

Detailed RoB ratings are displayed in Supplemental Material V. Most studies had a serious overall RoB. For 10 studies (seven of which were included in the main analyses), RoB was rated as moderate. In summary, there were a substantial number of studies with high RoB due to confounding, whereas bias due to selective reporting of results (including effect estimates) was rare. The funnel plots (Figure 4) highlight RoB across studies (publication bias). Neither the rank correlation nor the regression tests indicated any funnel plot asymmetry for the continuous loneliness scores (Z = 0.205, p = .238 and bias = 0.311, p = .756) or prevalence values ($Z = 0.236$, $p = .813$ and Kendall's $\tau = 0.286$, $p = .399$).

Additional Analysis: Metaregression

Results from the supplemental metaregression analyses are reported in Supplemental Material VI. The sample mean age, studies' overall RoB, and the type of study population nonsignificantly reduced the heterogeneity of the effect size estimators for loneliness. In the final model (21 studies, R^2 = .29), overall RoB rating (B = −0.35 [−0.64, −0.07]) was the only significant predictor, indicating that an overall lower RoB was associated with smaller effect sizes.

Discussion

The main aim of this study was to summarize the most recent high-quality evidence for changes in loneliness in association with the COVID-19 pandemic in a systematic and rigorous way. The statistical synthesis focused on longitudinal study designs. The robustness of the results was tested and predictors of change in loneliness were also explored. Based on the pooled effect sizes of 19 studies, an overall increase in loneliness since the start of the pandemic (SMD = 0.27 [0.14–0.40] for continuous measures) was found. This constitutes a small (Cohen, 1992; Ferguson, 2009) effect, which was also heterogeneous. An exploratory metaregression was modeled to statistically explain the observed variation.

The confidence in the finding that there has been an increase in loneliness—albeit small—during the pandemic is strengthened by the results of the sensitivity analyses, the inclusion of only high-quality and longitudinal research in the meta-analyses, the relatively large number of studies with a pooled sample of 45,734 participants, and the lack of any indication of publication bias.

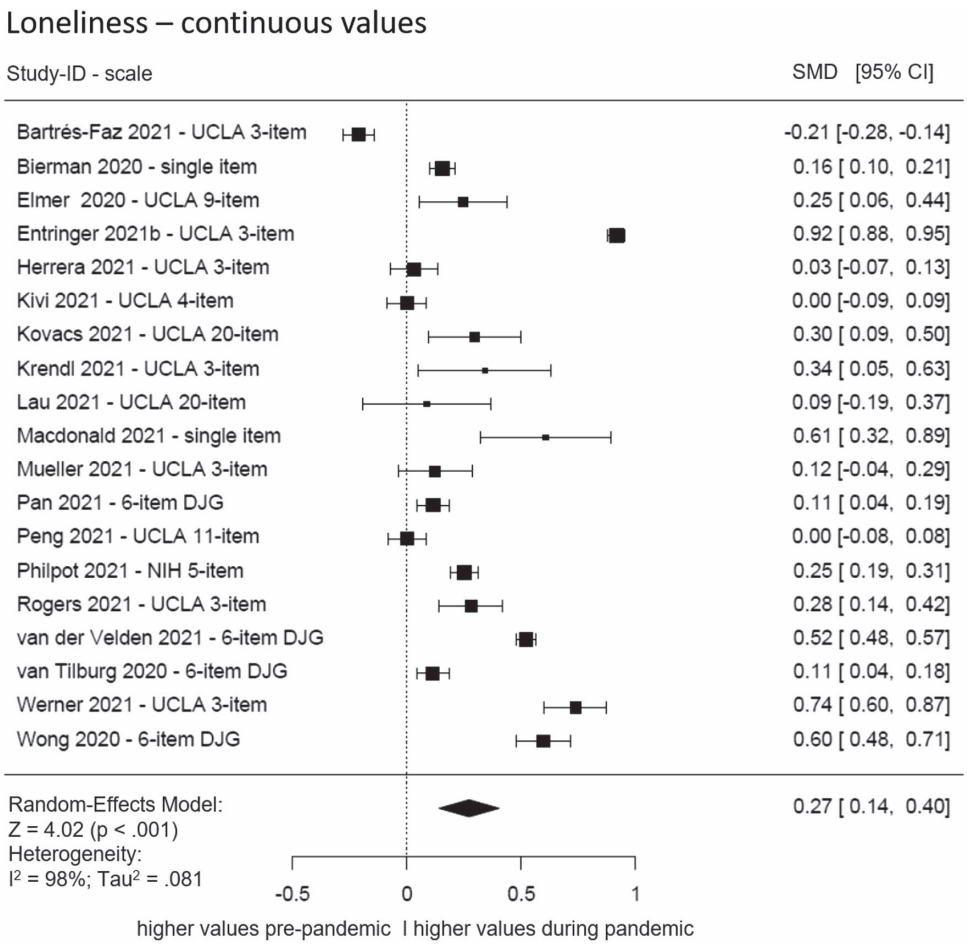
Anthony D. Ong

A previous rapid review and meta-analysis (Prati & Mancini, 2021) reported small increases in mental distress (overall g = 0.17) based on longitudinal studies. It also included three studies concerning loneliness conducted in spring 2020 (Luchetti et al., 2020; Niedzwiedz et al., 2021; Tull et al., 2020), only one of which (Niedzwiedz et al., 2021) could be included in the main analyses of this review (another one (Luchetti et al., 2020) was included in a sensitivity analysis). Their synthesis showed no statistically significant change in loneliness ($g = 0.12$, $p = .34$). The present study expands on this rapid review by including more original studies from different countries with assessments later in the pandemic.

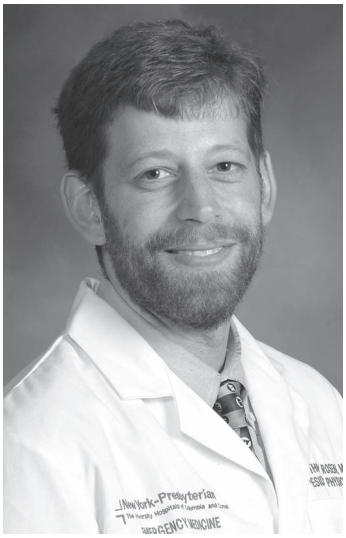
Another recent systematic review (Buecker & Horstmann, 2021), which did not synthesize its findings meta-analytically, reported based on 12 studies (three of which were included in this review (Bu et al., 2020; Heidinger & Richter, 2020; van Tilburg et al., 2020)) that most longitudinal investigations found increases in

Figure 2

Forest Plot for Reports of Continuous Loneliness Values Based on Longitudinal Original Studies



Note. The plot depicts model fit, individual study identifier (ID), and pooled effect size estimates (standardized mean differences and corresponding 95% confidence intervals). The size of the boxes corresponds to the respective studies' (inverse variance) weighting. SMD = standardized mean differences; CI = confidence interval; DJG = De Jong Gierveld Scale.



Tony Rosen

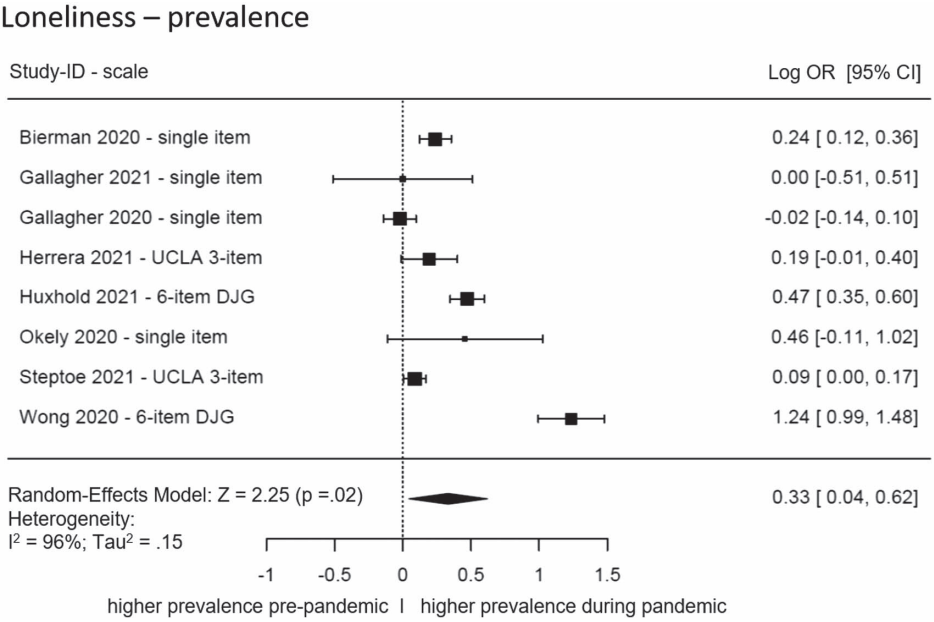
loneliness during the pandemic, which corresponds to the present findings. Studies showing decreasing loneliness had overwhelmingly relied on prepandemic assessments conducted shortly before the implementation of physical distancing, while those with comparison data from months or years before the pandemic had observed increased loneliness during the pandemic.

The present study extends previous knowledge on changes in loneliness during the pandemic; however, the observed increase needs to be interpreted with caution: On the one hand, loneliness can be considered a normal, nonpathological reaction to changing circumstances and many people experience it at some point in their lives. On the other hand, previous research has shown that particularly sustained or chronic loneliness jeopardizes mental and physical health (Cacioppo et al., 2015; National Academies of Science, Engineering, & Medicine, 2020), and the ongoing pandemic and associated restrictions could compromise lonely individuals' efforts to reconnect with others (Qualter et al., 2015).

Furthermore, the overall pooled effect in this study was small and the effect sizes reported by the individual studies were heterogeneous. The numerical values of effect size indices often provide limited understanding of the real-world significance of those effects, as even statistically small effects can be of high importance (e.g., Meyer et al., 2001). Interestingly, the most rigorous analysis (the sensitivity analyses that included only longitudinal study designs and studies with moderate RoB) showed a larger pooled effect size than the main analyses. This mirrors findings of the metaregression, in which studies' higher RoB was negatively associated with the observed effect sizes. Taken together, these results suggest that the pooled effect in the present study might underestimate effects in at-risk populations.

Figure 3

Forest Plot for Reports of Prevalence Rates of Loneliness Based on Longitudinal Original Studies



Note. The plot depicts model fit, pooled effect size estimates (log odds ratios), and the corresponding study results and identifiers (IDs). The size of the boxes corresponds to the respective studies' weighting. Log OR = log odds ratio; CI = confidence interval; DJG = De Jong Gierveld Scale.

Elmar Brähler

The heterogeneity of effects might stem from the diversity of study characteristics included in prior research (e.g., age groups, healthy and clinical populations, regions, study designs, and loneliness measures). However, the fact that the metaregression accounted for less than a third of observed variance suggests that other factors may influence the different trajectories of loneliness in the pandemic context. As some original studies failed to report on previously identified vulnerable groups (e.g., individuals living alone), these could not be tested as predictors. Hence, more high-quality studies that assess risk and protective factors are needed so that their relevance can be assessed across samples. This is an important step to inform targeted prevention efforts.

The metaregression identified age, clinical populations, and studies' overall RoB as predictors of increases in loneliness, but only overall RoB had statistically significant effects. However, the analysis might have been underpowered as it was not possible to test all predictors of interest simultaneously. While neither of two other available reviews conducted a metaregression to explore characteristics associated with changes in loneliness (Buecker & Horstmann, 2021; Prati & Mancini, 2021), Prati and Mancini (2021) explored, using metaregression, predictors of increases in mental health symptoms during the pandemic. They found no effects of mean age, gender, or study design, either. More research is needed to better understand the mechanisms underlying observed changes in loneliness. They could include response biases such as social desirability or the perceived destigmatization of loneliness: learning that loneliness is an experience shared by many during the pandemic might make it easier to acknowledge and disclose one's social needs.

Another question that should be addressed is whether changes in loneliness are primarily driven by changes in perceived relationship quality or quantity, and if this differs according to individual characteristics or in subpopulations (e.g., age groups). As a consequence, efforts aimed at preventing or reducing loneliness could pursue different strategies. For example, individuals who are lonely because they are socially isolated and have few contacts might benefit from programs fostering exchange, ideally across different living contexts and between generations. Previous research has shown positive effects of interventions enhancing social support (such as buddy-care programs; Masi et al., 2011). Within the pandemic context, these types of interventions could be carried out digitally or within small "social-support-bubbles." Others might not feel that they have too few contacts overall, but instead be dissatisfied with their close relationships. Research has shown that people in conflictual relationships feel lonelier than those who perceive their relationships as supportive (Hsieh & Hawkley, 2018; Selcuk & Ong, 2013). As the pandemic implicates a myriad of stressors affecting relationships, interventions could target the quality of partner relationships, parent–child relationships, or other configurations in which people live together, for example, through better communication (about feelings and worries, needs for support, etc.). Further approaches at the individual level might also focus on strategies to modify maladaptive social cognitions (which Masi et al. (2011) found to be the most effective). As individuals differ with respect to their ability to adapt to new situations, some might benefit from interventions aimed at changing attitudes and expectations regarding social contacts during a pandemic (e.g., regarding availability, spontaneity, and modality).

In general, prevention and intervention programs should address particularly vulnerable groups such as older

Table 2
Outcomes of the Sensitivity Analyses

Selection criterion for inclusion in sensitivity analysis	Number of effect sizes *k*	SMD	95% CI	*Z*	*p*	I^2
No "serious" or "critical" risk of overall bias	5	0.41	[0.11, 0.71]	2.66	<.001	99%
Including pseudolongitudinal study designs	25	0.30	[0.17, 0.42]	4.71	<.001	99%
Including studies whose prepandemic assessment overlapped with the cutoffs	21	0.27	[0.14, 0.39]	4.04	<.001	98%
No clinical populations	17	0.26	[0.12, 0.40]	3.61	<.001	98%

Note. The table displays the number of effect sizes included in the analyses, homogeneity (I^2), SMDs, their confidence intervals, and corresponding *Z* and *p* values. CI = confidence interval. SMD = standardized mean difference.

Manfred E. Beutel

individuals without internet access. Concerns have been raised about their lack of representation in large-scale, longitudinal investigations of loneliness (Dahlberg, 2021), so care must be taken to ensure that preventive measures address the needs and reach the breadth of the population instead of focusing on those who are most likely to be research participants. It should also be a research desideratum to include the most hard-to-reach members of the community.

Strengths and Limitations Including Constraints on Generality

The present study synthesized substantially more original reports than previous rapid and systematic reviews. The meta-analyses' focus on longitudinal study designs is another strength. Besides peer-reviewed publications, this review included studies identified via other sources, for example, preprint servers (but no unpublished studies). In addition to longitudinal studies, pseudolongitudinal studies were included in the narrative synthesis and in the exploratory metaregression. However, the informative value of the metaregression was still hampered by the limited number of predictors that could be tested on the basis of the available studies (which also necessitated a stepwise procedure).

The lack of control samples unaffected by the pandemic weakens possible causal inference, making it more difficult to attribute the increase in loneliness to the pandemic. Furthermore, an alternative explanation for increases in loneliness in the population was recently provided by Buecker et al. (2021) who reported linear increases in emerging adults over the last decades. The discussion of underlying period and/or cohort effects included more flexible social (including romantic) relationships, use of communication technology, and occupational instability. At the same time, some of these trends resulting in individuals having many, but weak social ties may have particularly come into effect in the pandemic context.

RoB assessments revealed that most original reports had a serious RoB in at least one domain, for example, regarding the measurement of loneliness (including the use of untested single items or adaptations of questionnaires originally intended to measure other constructs). Although sensitivity analyses supported the results' robustness with respect to studies' overall RoB, the metaregression suggested that it could have led to an underestimation of the magnitude of changes in loneliness.

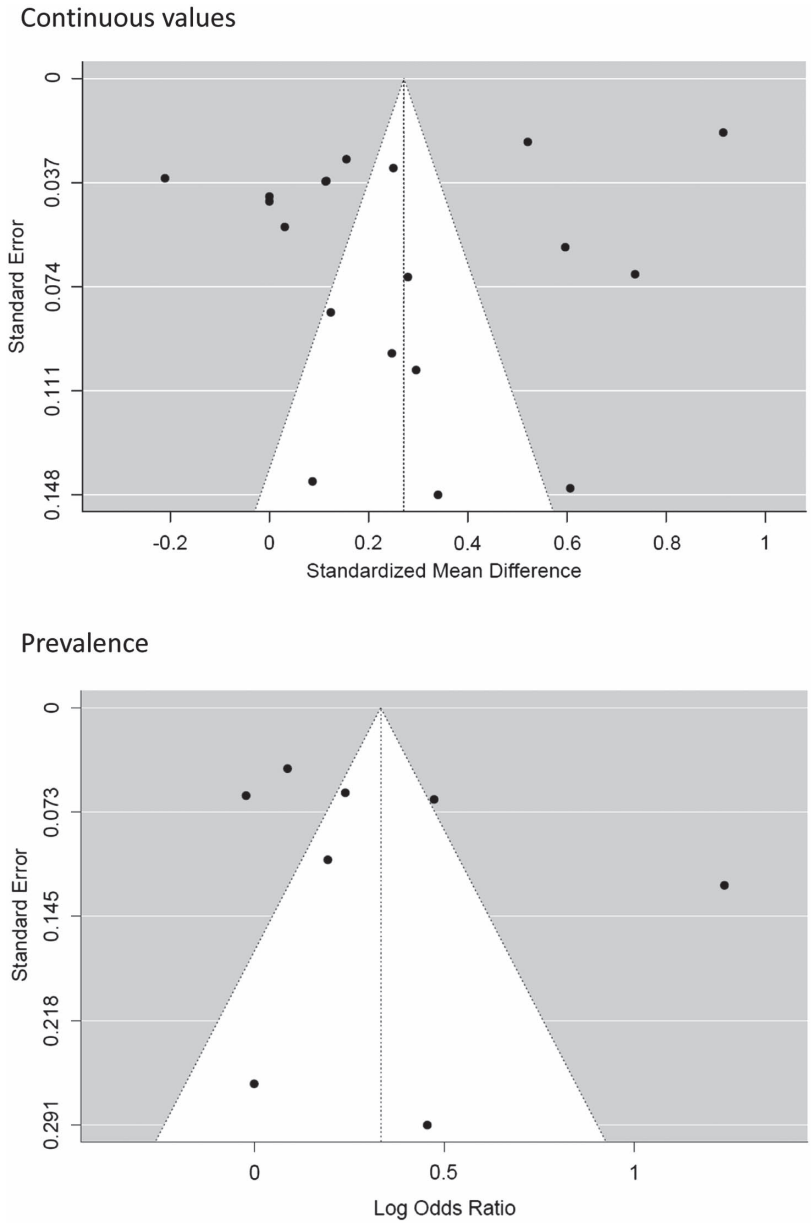
Further, some variables could only be included in the analyses in ways that reduced the complexity of original study designs/dynamic situations: First, the duration between loneliness assessments was often a range and not a concrete number of days/months. The present analyses used the respective midpoint of this range. For the duration of pandemic-related restrictions, the same procedure was employed. Restriction measures were coded based on official mandates, however, this might have been imprecise if measures differed between regions and/or if the assessment spanned a period in which these rules changed. There was also little information available regarding participants' adherence to restrictions. Thus, in summary, the study design was not suited to determine effects of (specific) restrictions on loneliness. Furthermore, as the pandemic progressed differently around the world, we used regional cutoffs to distinguish whether study assessments had taken place before or during the pandemic, but individuals might also have been affected by restrictions outside their place of residence (e.g., travel bans). However, a sensitivity analysis confirmed the results' robustness regarding findings of studies whose "pre-pandemic" assessment overlapped with the introduced cutoffs.

As included studies mainly derived from the U.S. and Europe, whereas South America, Asia/Oceania, and Africa were underrepresented, the present findings might not be generalizable to populations not conforming to the WEIRD (Western, educated, industrialized, rich, and democratic) stereotype (Henrich et al., 2010). Further, the original investigations might have omitted specific groups, such as immigrants not speaking the country's official language, people with mental and/or physical disabilities, and those without regular internet access, if conducted online.

Conclusion

The present study summarizes the recent research on changes in loneliness since the start of the COVID-19

Figure 4
Funnel Plots of the Effect Size Estimators for Loneliness



Note. The dots represent the individual studies. Standardized mean differences are plotted against standard errors.

pandemic. The synthesis of longitudinal studies indicates increases in loneliness. However, observed effects were small and heterogeneous, suggesting that at this point in time, concerns about a "loneliness pandemic" are likely overblown. However, as loneliness constitutes a risk for premature mortality and mental and physical health, it should be closely monitored, ideally in combination with potential risk and protective factors and health outcomes to derive appropriate interventions.

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